*TB 9-6625-2265-24

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR DIGITAL MULTIMETER BALLANTINE, MODEL 3100A

Headquarters, Department of the Army, Washington, DC
5 September 2007

REPORTING OF ERRORS AND RECOMMENDING IMPROVEMENTS

You can improve this manual. If you find any mistakes or if you know of a way to improve these procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms) directly to: Commander, U.S. Army Aviation and Missile Command, ATTN: AMSAM-MMC-MA-NP, Redstone Arsenal, AL 35898-5000. A reply will be furnished to you. You may also send in your comments electronically to our E-mail address: 2028@redstone.army.mil or by fax 256-842-6546/DSN 788-6546. For the World Wide Web use: https://amcom2028.redstone.army.mil. Instructions for sending an electronic 2028 can be found at the back of this manual.

*This bulletin supersedes TB 9-6625-2265-35, dated 18 March 2002.

SECTION I
IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Digital Multimeter, Ballantine, Model 3100A. The manufacturer's manual was used as the prime data source in compiling these instructions. The equipment being calibrated will be referred to as the TI (test instrument) throughout this bulletin.

a. Model Variations. None.

b. Time and Technique. The time required for this calibration is approximately 1 hour using the dc and low frequency technique.

2. Forms, Records, and Reports

a. Forms, records, and reports required for calibration personnel at all levels are prescribed by TB 750-25.

b. Adjustments to be reported are designated (R) at the end of the sentence in which they appear. Report only those adjustments made and designated with (R).

3. Calibration Description. TI parameters and performance specifications which pertain to this calibration are listed in table 1.

Table 1. Calibration Description

Test instrument parameters	Performance specifications (3 1/2 digit display)
Dc voltage	Range: 0 to 1000 V (in 5 ranges) Accuracy: ± (0.1% of reading + 1 digit)
Ac voltage	Range: 0 to 750 V (in 5 ranges) Frequency: 40 Hz to 5 kHz Accuracy: ± (% of reading + digits)

Range		Frequency		
		40 Hz to 1 kHz	1 to 2 kHz	2 to 5 kHz
200	mV	.75 + 2	1.5 + 3	5.0 + 5
2	V			
20	V			
200	V			N/A
750	V	1.0 + 2	N/A	N/A

Resistance	Range: 0 to 20 MΩ (in 6 ranges) Accuracy: ± (% of reading + digits) Range: 200 Ω ..... 0.2 + 3 2 through 200 kΩ ..... 0.1 + 1 2 MΩ ..... .15 + 1 20 MΩ ..... 2.0 + 1

Table 1. Calibration Description - Continued

Test instrument parameters	Performance specifications (3 1/2 digit display)
Dc current	Range: 0 to 10 A (in 6 ranges) Accuracy: ± (% of reading + digits) Range: 200 µA to 2A..... 0.75 + 1 10 A ..... 1.5 + 1
Ac current [1]	Range: 0 to 10 A (in 6 ranges) Accuracy: ±(% of reading + digits)

Range	Frequency	
	45 to 450 Hz	450 Hz to 1 kHz
200 µA through 2 A	1.5 + 2	1.5 + 2
10 A	3.0 + 2	5.0 + 3

[1]Ac current verified during dc current check since same shunt resistors are utilized for both functions.

SECTION II
EQUIPMENT REQUIREMENTS

4. Equipment Required. Table 2 identifies the specific equipment to be used in this calibration procedure. This equipment is issued with Secondary Transfer Calibration Standards Set AN/ GSM-286 AN/GSM-287, or AN/GSM-705. Alternate items may be used by the calibrating activity. The items selected must be verified to perform satisfactorily prior to use and must bear evidence of current calibration. The equipment must meet or exceed the minimum use specifications listed in table 2. The accuracies listed in table 2 provide a four-to-one ratio between the standard and TI. Where the four-to-one ratio cannot be met, the actual accuracy of the equipment selected is shown in parenthesis.

5. Accessories Required. The accessories required for this calibration are common usage accessories, issued as indicated in paragraph **4** above, and are not listed in this calibration procedure.

Table 2. Minimum Specifications of Equipment Required

Common name	Minimum use specifications	Manufacturer, and model (part number)
CALIBRATOR	Dc voltage: Range: -190 mV to 1000 V Accuracy: ± (%) 190 mV to 190 V ..... 0.039 1000 V ..... 0.050 Ac voltage: Range: 190 mV to 750 V Frequency: 40 Hz to 5 kHz Accuracy: ±(%) Frequency — Voltage 40 Hz and 1.0 kHz — 190 mV through 190 V..... 0.211 2.0 kHz — 190 mV through 190 V..... 0.421 5.0 kHz — 190 mV through 19 V..... 1.316 50 Hz and 1.0 kHz — 750 V..... 0.333	Fluke, Model 5720A (p/o MIS-35947) w/power amplifier, Fluke, Model 5725A (5725A) w/ac divider, Fluke, Model 7405A-4207 (7405A-4207)

Table 2. Minimum Specifications of Equipment Required - Continued

Common name	Minimum use specifications	Manufacturer, and model (part number)
CALIBRATOR (continued)	Resistance: Range: 190 Ω to 19 MΩ Accuracy: ± (%) 190 Ω .... 0.089 1.9 through 190 Ω ..... 0.038 1.9 MΩ ..... 0.051 19 MΩ ..... 0.513 Dc current: Range: 190 μA to 10 A	

SECTION III
CALIBRATION PROCESS

6. Preliminary Instructions

a. The instructions outlined in paragraphs **6** and **7** are preparatory to the calibration process. Personnel should become familiar with the entire bulletin before beginning the calibration.

b. Items of equipment used in this procedure are referenced within the text by common name as listed in table 2.

c. Unless otherwise specified, verify the results of each test and, whenever the test requirement is not met, take corrective action before continuing with the calibration. Additional maintenance information is contained in the manufacturer's manual for this TI.

d. Unless otherwise specified, all controls and control settings refer to the TI.

7. Equipment Setup

WARNING

HIGH VOLTAGE is used or exposed during the performance of this calibration. DEATH ON CONTACT may result if personnel fail to observe safety precautions. REDUCE OUTPUT(S) to minimum after each step within the performance check where applicable.

a. Remove bottom cover from TI only to make adjustments and replace upon completion.

b. Set **POWER** switch to **ON**.

c. Set **PEAK HOLD** switch to **OFF**.

8. Dc Voltage

a. Performance Check

(1) Connect calibrator **OUTPUT** terminals to TI **V-Ω** and **COM** terminals and set TI **FUNCTION/RANGE** dial to **DCV 2**.

(2) Set TI **FUNCTION/RANGE** dial and calibrator output as specified in table 3. If TI does not indicate within the specified limits, perform **b** below.

b. Adjustments. Set TI **FUNCTION/RANGE** dial to **DCV 200m** and calibrator for a 190 mV dc output. Adjust VR1 DC 200 mV (fig. 1) for a TI indication of 190.0 mV (R).

Table 3. Dc Voltage

Test instrument **FUNCTION/RANGE** dial (DCV)	Calibrator output (V dc)	Test instrument	
		Min	Max
2	1.9	1.897	1.903
200 m	.19	189.7	190.3
200 m	-.19	-189.7	-190.3
20	19	18.97	19.03
200	190	189.7	190.3
1000	1000	998	1002

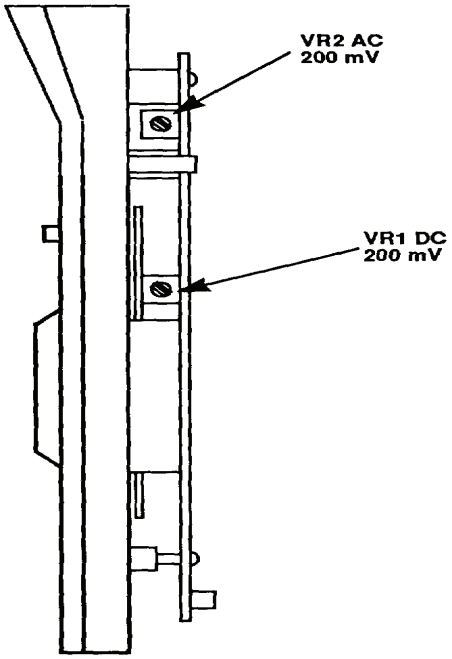

Figure 1. Adjustment locations.

9. Ac Voltage

a. Performance Check

(1) Ensure calibrator **OUTPUT** terminals are connected to TI **V-Ω** and **COM** terminals and set TI **FUNCTION/RANGE** dial to **ACV 2.**

(2) Set TI **FUNCTION/RANGE** dial and calibrator for voltages and frequencies listed in table 4. TI will indicate within the specified limits; if not, perform **b** below.

b. Adjustments. Set TI **FUNCTION/RANGE** dial to **ACV 200m** and calibrator for a 190 mV, 400 Hz output. Adjust VR2 AC 200 mV (fig. 1) for a TI indication of 190.0 mV (R).

Table 4. Ac Voltage

Test instrument **FUNCTION/RANGE** dial (ACV)	Calibrator output		Test instrument indications	
	Voltage	Frequency	Min	Max
200 M	190 mV	40 Hz	188.4	191.6
200 M	190 mV	1.0 kHz	188.4	191.6
200 M	190 mV	2.0 kHz	186.8	193.2
200 M	190 mV	5.0 kHz	180.0	199.9
2	1.9 V	40 Hz	1.884	1.916
2	1.9 V	1.0 kHz	1.884	1.916
2	1.9 V	2.0 kHz	1.868	1.932
2	1.9 V	5.0 kHz	1.800	1.999
20	19 V	40 Hz	18.84	19.16
20	19 V	1.0 kHz	18.84	19.16
20	19 V	2.0 kHz	18.68	19.32
20	19 V	5.0 kHz	18.00	19.99
200	190 V	40 Hz	188.4	191.6
200	190 V	1.0 kHz	188.4	191.6
200	190 V	2.0 kHz	186.8	193.2
750	750 V	50 Hz	740	760
750	750 V	1.0 kHz	740	760

10. Dc Current

a. Performance Check

(1) Connect calibrator **OUTPUT** terminals to TI **A** and **COM** terminals.

(2) Set TI **FUNCTION/RANGE** dial to **DCA 200μ**.

(3) Set calibrator **OUTPUT** for **190 μA**. Digital multimeter will indicate between 188.5 and 191.5.

(4) Repeat technique of steps (2) and (3) above using settings and indications listed in table 5. TI display will indicate within limits specified in table 5.

Table 5. Dc Current

Test instrument **FUNCTION/RANGE** dial (DCA) settings	Calibrator initial output	Test instrument display indications	
		Min	Max
2 m	1.9 mA	1.885	1.915
20 m	19 mA	18.85	19.15
200 m	190 mA	188.5	191.5
2	1.9 A	1.885	1.915
10 A[1]	9 A	8.85	9.15

[1]Move TI input lead from A to 10A terminal and move test leads located at calibrator **OUTPUT** terminals to boost amplifier HI and LO terminals.

b. Adjustments. No adjustments can be made.

11. Resistance

a. Performance Check

(1) Connect calibrator **OUTPUT** terminals to TI **V-Ω** and **COM** terminals and set TI **FUNCTION/RANGE** dial to **Ω 20 M**.

(2) Set TI **FUNCTION/RANGE** dial and calibrator to the nominal resistance outputs as listed in table 6. At each resistance output, adjust the calibrator output adjustment control knob for a calibrator control display reading equal to the TI indication. The calibrator control display **ERROR** indication will be within the specified limits of table 6.

Table 6. Resistance

Test instrument **FUNCTION/RANGE** dial (Ω)	Calibrator output nominal value	Calibrator **ERROR** display indication ±(%)
20 M	19 MΩ	2.05
2 M	1.9 MΩ	.203
200 k	190 kΩ	.153
20 k	19 kΩ	.153
2 k	1.9 kΩ	.153
200	190 Ω	.358

b. Adjustments. No adjustments can be made.

12. Final procedure

a. Deenergize and disconnect all equipment.

b. Annotate and affix DA label/form in accordance with TB 750-25.

By Order of the Secretary of the Army:

GEORGE W. CASEY, JR.
General, United States Army
Chief of Staff

Official:

JOYCE E. MORROW
Administrative Assistant to the
Secretary of the Army

0719010

Distribution:

To be distributed in accordance with the initial distribution number (IDN) 344416, requirements for calibration procedure TB9-6625-2265-24.

Instructions for Submitting an Electronic 2028

The following format must be used if submitting an electronic 2028. The subject line must be exactly the same and all fields must be included; however, only the following fields are mandatory: 1, 3, 4, 5, 6, 7, 8, 9, 10, 13, 15, 16, 17, and 27.

From: "Whomever" whomever@redstone.army.mil
To: <2028@redstone.army.mil

Subject: DA Form 2028
1. **From**: Joe Smith
2. Unit: home
3. **Address**: 4300 Park
4. **City**: Hometown
5. **St**: MO
6. **Zip**: 77777
7. **Date Sent**: 19-OCT –93
8. **Pub no:** 55-2840-229-23
9. **Pub Title**: TM
10. **Publication Date**: 04-JUL-85
11. Change Number: 7
12. Submitter Rank: MSG
13. **Submitter FName**: Joe
14. Submitter MName: T
15. **Submitter LName**: Smith
16. **Submitter Phone**: 123-123-1234
17. **Problem**: 1
18. Page: 2
19. Paragraph: 3
20. Line: 4
21. NSN: 5
22. Reference: 6
23. Figure: 7
24. Table: 8
25. Item: 9
26. Total: 123
27. **Text**

This is the text for the problem below line 27.